(12) UK Patent Application (19) GB (11) 2 212 638 (13) A

(43) Date of A publication 26.07.1989

(21) Application No 8829270.1

(22) Date of filing 15.12.1988

(30) Priority data
(31) 62324446 (32) 21.12.1987 (33) JP

(51) INT CL⁴
G06F 15/20 11/00

(52) UK CL (Edition J)
G4A AUX
U1S S1820

(56) Documents cited
EP 0053561 A2

(58) Field of search
UK CL (Edition J) G4A AFMA AUX
INT CL⁴ G06F

(71) Applicant
Fuji Jukogyo Kabushiki Kaisha

(Incorporated in Japan)

7-2 Nishishinjuku 1-chome, Shinjuku-ku, Tokyo, Japan

(72) Inventors
Abe Kunihiro
Tomoya Kobyashi

(74) Agent and/or Address for Service
Batchellor Kirk & Eyles
2 Pear Tree Court, Farringdon Road, London, EC1R 0DS, United Kingdom

(54) Diagnostic system for a motor vehicle

(57) A system for diagnosing a motor vehicle has a diagnosis device 25 including a computer having a central processing unit and a memory, the memory having a plurality of programs for diagnosing the engine's electronic control system 2. Terminals 47*a*, 47*b* are provided on a case of the diagnosis device for receiving analog signals from electrical components of the vehicle via probes 46. An analog to digital converter in a memory cartridge 34 connects the terminals with the diagnosis device. A wiring harness 27 connects the device 25 temporarily to the control system 2.

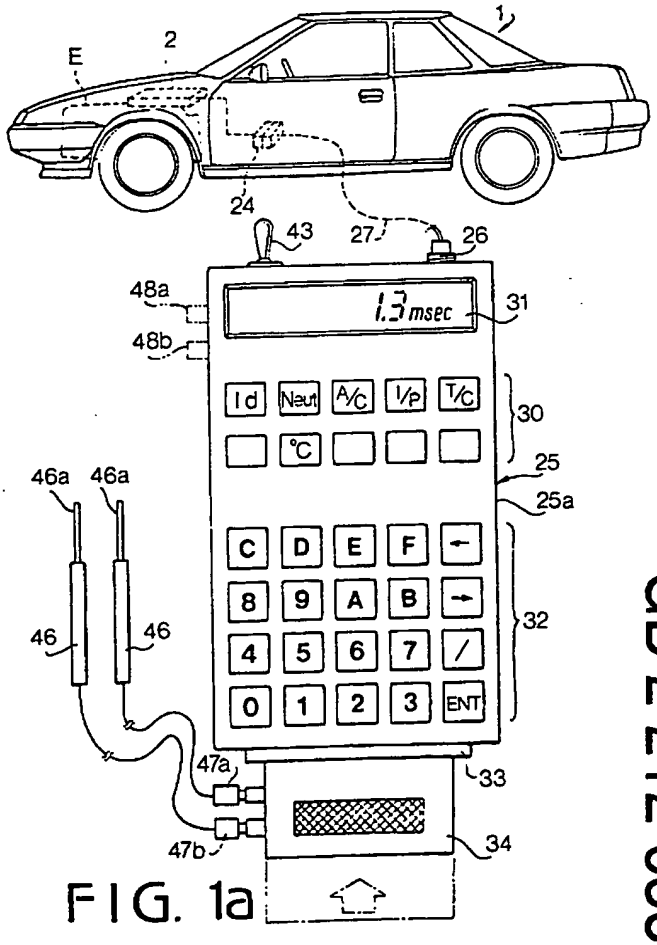


FIG. 1a

GB 2 212 638 A

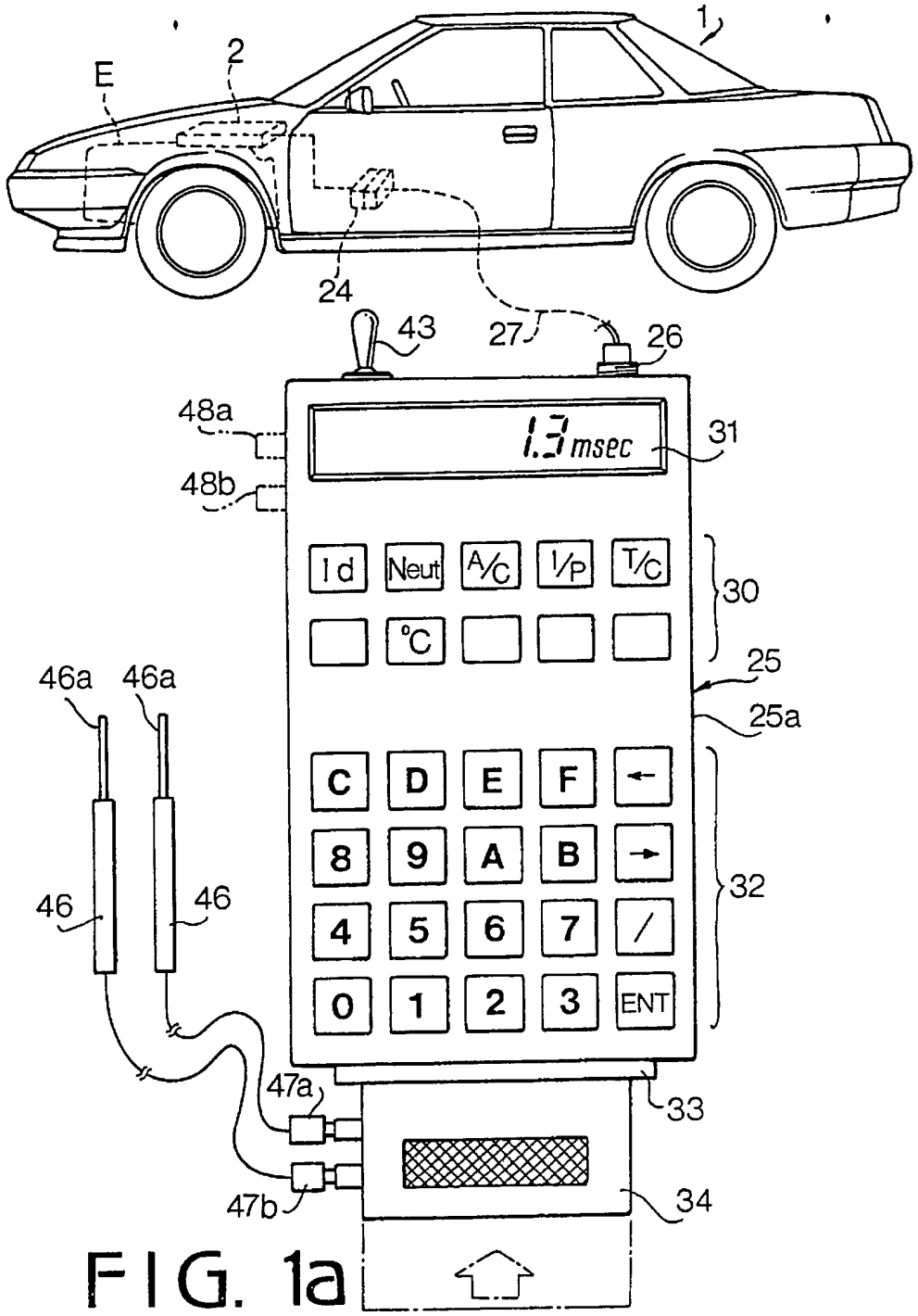


FIG. 1a

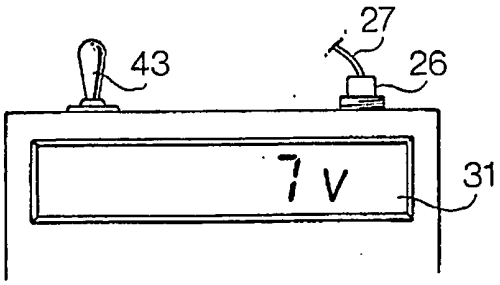


FIG. 1b

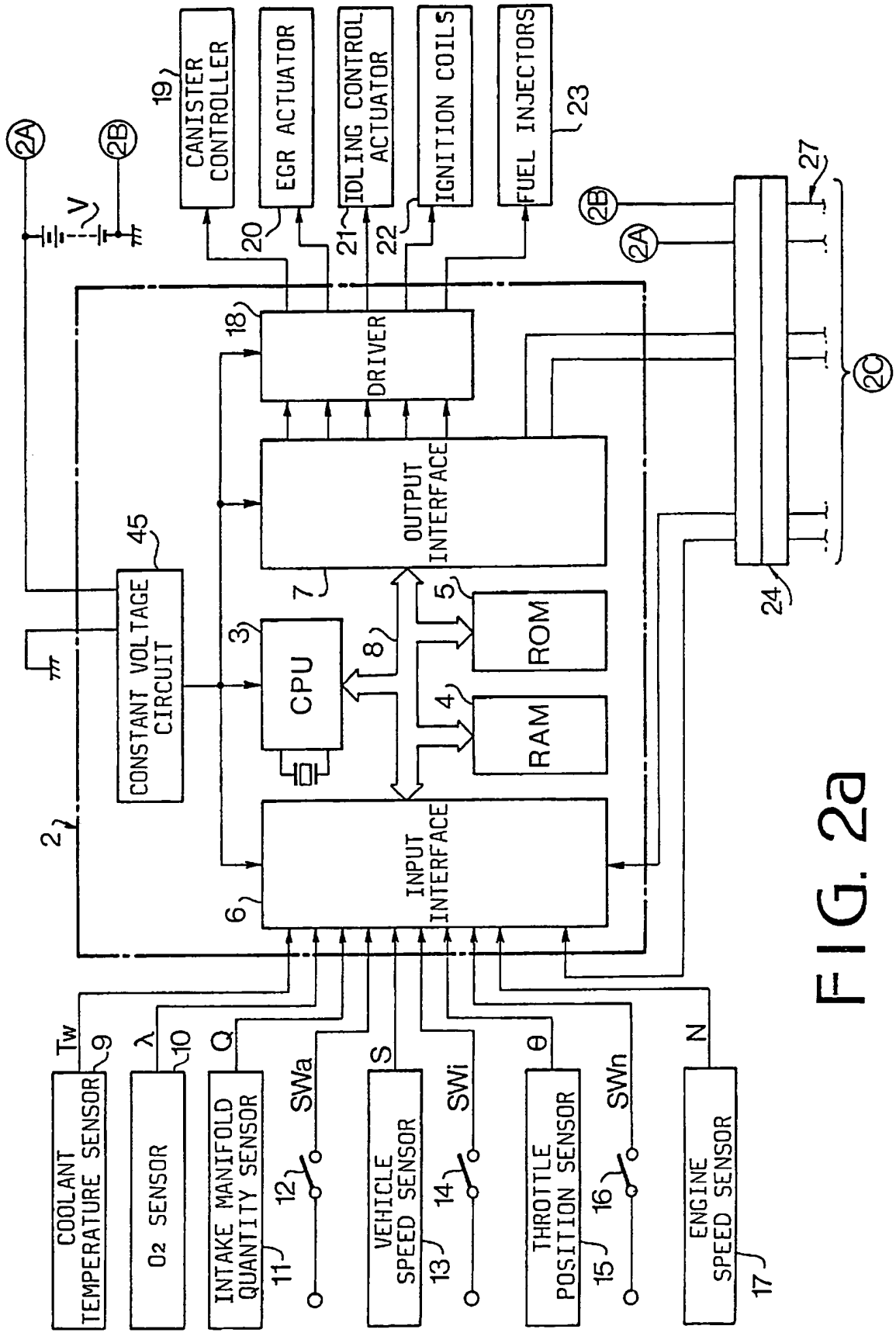
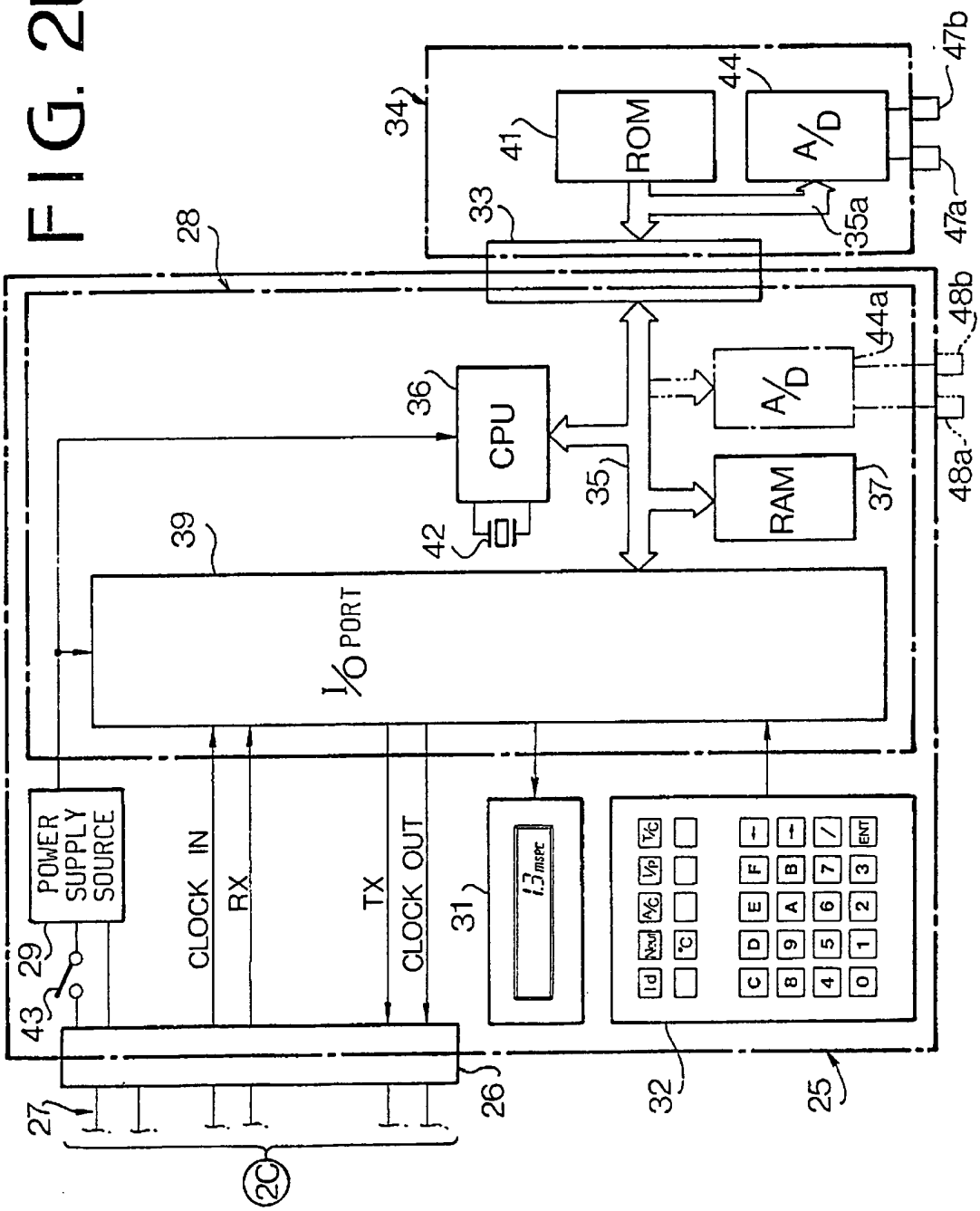


FIG. 2a

FIG. 2b


28
34
41
ROM
44
A/D
47b
47a
35a
33
48b
44a
48a
36
CPU
35
RAM
37
42
39
I/O PORT
POWER SUPPLY SOURCE
29
43
CLOCK IN
RX
TX
CLOCK OUT
31
27
26
32
25
2C

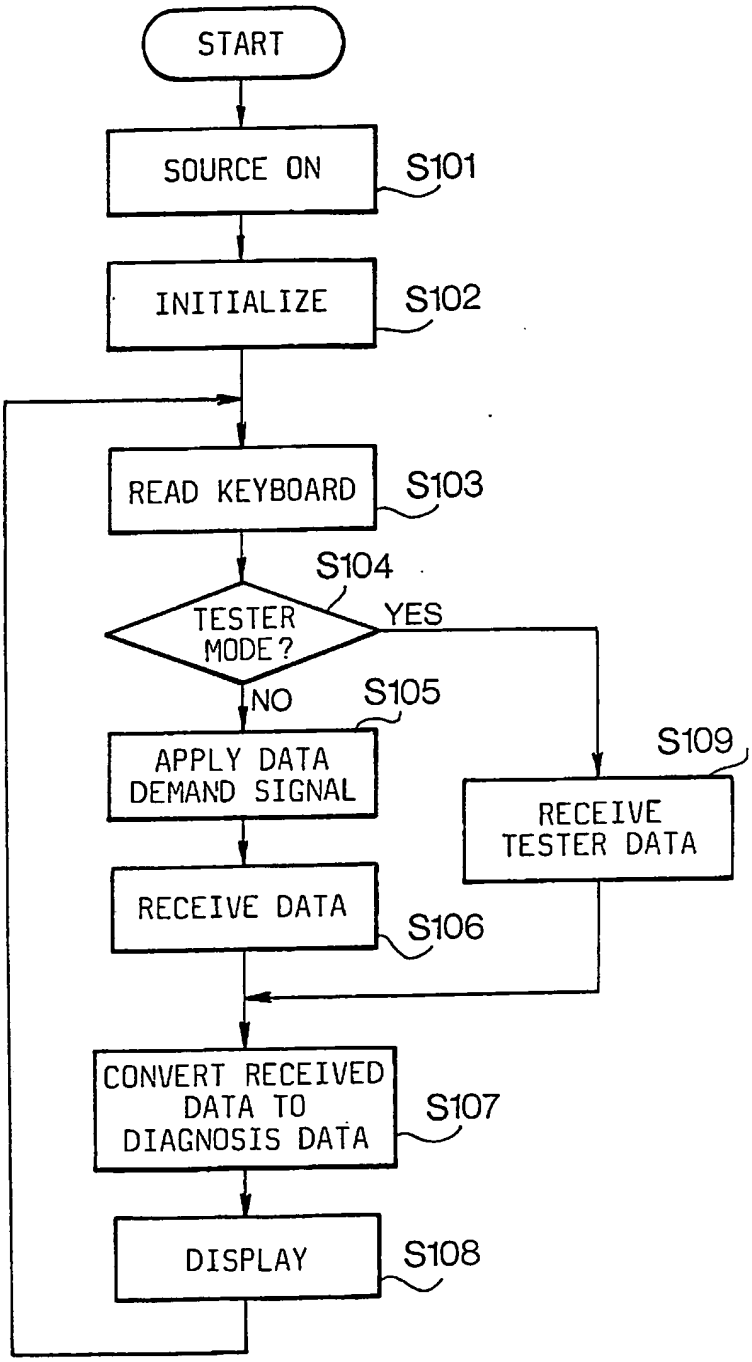


FIG. 3

Diagnostic System For A Motor Vehicle 2212633

The present invention relates to a diagnostic system for a motor vehicle, and more particularly to a system provided with a device for checking automotive electric systems.

It is known for a motor vehicle to be equipped with an electronic control system for controlling various components of the engine, such as fuel injectors, to thereby improve driveability, exhaust gas emission, fuel consumption, and engine power. The electronic control system controls the components based on information represented by output signals from various sensors arranged to detect engine operating conditions. Accordingly, if malfunctions of components and sensors occur, the engine does not operate properly.

However, because of the complexity of the electronic control system, it is difficult to immediately locate faults. Accordingly, a fault diagnostic device for easily checking the electronic control system is required.

Japanese Patent Application Laid-Open 58-12848 discloses a diagnostic system in which an exclusive checking device is provided for measuring pulse duration of fuel injection and engine speed, and for checking whether idling speed is normal. The checking device is provided for diagnosing only specific designated types of motor vehicles.

However, the main aim of the conventional diagnostic system is to monitor input and output signals of the electronic control system. Accordingly, when trouble shooting, in order to check voltage of elements such as various switches and electronic meters in an automotive electric system, or to check the grounding or connection of harness thereto in an electric circuit, a tester must be additionally used. Thus, the operation

becomes troublesome.

An object of the present invention is to provide a diagnostic system for a motor vehicle where automotive electric systems can be easily checked as well as the electronic control system.

According to the present invention, there is provided a device for diagnosing an electronic control system of a motor vehicle, said device comprising a control unit including a computer having a central processing unit and a memory having a plurality of programmes for diagnosing the control system; an analogue to digital converter having input terminals arranged to receive analogue signals from electrical components of the vehicle and output terminals connected to the computer; and means for temporarily connecting the control unit to the electronic control system.

In one aspect of the invention, the terminals are provided on a cartridge detachably attached to the case.

In order that the invention may be more readily understood it will now be described, by way of example only, with reference to the accompanying drawings in which:

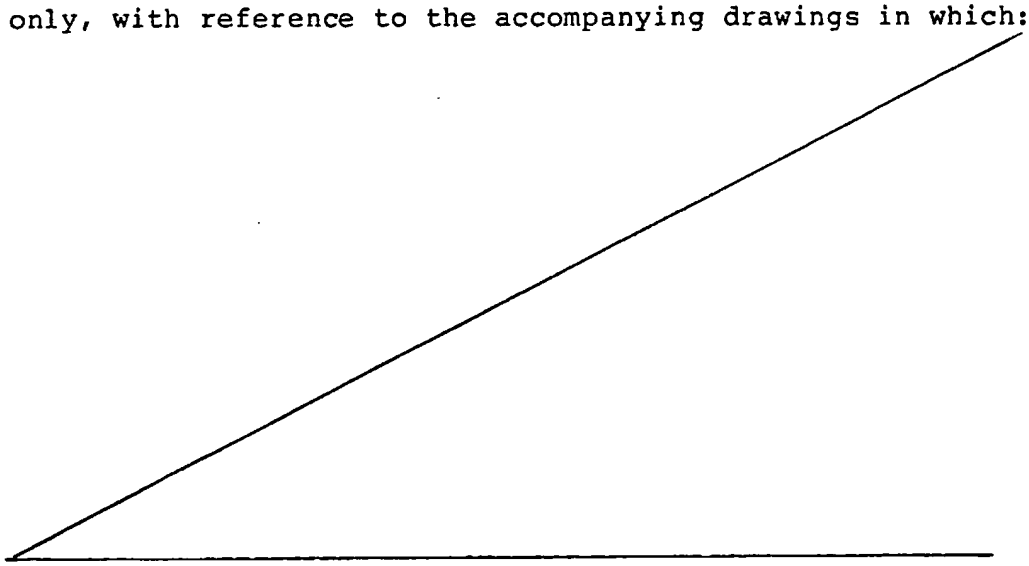


Figure 1a is a schematic illustration of a diagnostic system according to the present invention;

Fig. 1b shows a display of a diagnostic device at tester mode;

Figs. 2a and 2b are a block diagram of the system; and

Fig. 3 is a flowchart showing an operation of the system.

Referring to Fig. 1, an automobile 1 is equipped with an electronic control system 2 for controlling various components of an engine E. The electronic control system 2 is connected to an external connector 24. A portable diagnostic device 25 including a microcomputer is housed in a case 25a and has a connector 26, to which the connector 24 of the system 2 is connected through an adapter harness 27.

The device 25 has a power switch 43, a liquid crystal display 31, an indicator section 30 consisting of a plurality of indicators of LED, and a keyboard 32. A connector 33 is provided for connecting a detachable memory cartridge 34.

Referring to Figs. 2a and 2b, the electronic control system 2 comprises a central processor unit (CPU) 3, a random access memory (RAM) 4, a read only memory (ROM) 5, an input

interface 6 and an output interface 7. These CPU 3, RAM 4, ROM 5, input and output interfaces 6 and 7 are connected to each other through a bus line 8. Programs and data for controlling the engine are stored in the ROM 5. Power is supplied to the CPU 3, input and output interfaces 6 and 7, and driver 18 from a source V through a constant voltage circuit 45.

The input interface 6 is applied with a coolant temperature signal Tw from a coolant temperature sensor 9, an air-fuel ratio feedback signal λ from an O_2 sensor 10, an intake-air quantity signal Q from an intake manifold quantity sensor 11, an air conditioner operating signal SWa from an air conditioner switch 12, a vehicle speed signal S from a vehicle speed sensor 13, an idling signal SWi from an idle switch 14, a throttle valve opening degree signal θ from a throttle position sensor 15, a neutral positioning signal SWn from a neutral switch 16 in a transmission, and an engine speed signal N from an engine speed sensor 17. These signals are stored in the RAM 4 after data processing in accordance with the program stored in the ROM 5. The CPU 3 produces respective control signals, which are applied to the driver 18 through the output interface 7. The driver 18 produces signals for controlling a canister controller 19 of a fuel-vapor emission control system, an EGR (exhaust gas recirculation system) actuator 20, an idling control actuator 21, ignition coils 22, and fuel injectors 23.

The diagnosis device 25 has a control unit 28 and a power supply source 29. The control unit 28 comprises a CPU 36, a RAM 37, and input/output (I/O) port 39. These elements are connected to each other through a bus line 35. A clock pulse generator 42 is provided for generating synchronizing pulses. A ROM 41 provided in the memory cartridge 34 is connected to the bus line 35 through the connector 33. The ROM 41 stores a plurality of programs for diagnosing various troubles of the control system 2. Inputs of the I/O port 39 are connected to the output interface 7 of the control system 2 through connectors 24 and 26 and harness 27 so as to receive output signals of sensors and switches 9 to 17. Inputs of the I/O port 39 are connected to the keyboard 32 for applying with a mode select signal dependent on the operation of the keyboard, and to the output interface 7. Outputs of the port 39 are connected to the input interface 6 and the display 31. The power source 29 for supplying the power to the CPU 36 and I/O port 39 is connected to the source V through the power switch 43.

The memory cartridge 34 has an analog to digital (A/D) converter 44 which is connected with the control unit 28 of the diagnosis device 25 through a bus line 35a. Input terminals of the A/D converter 44 is connected to terminals 47a and 47b on the cartridge 34. In order to check automotive electric systems, probes 46, each having a probe tip 46a at an end thereof, are detachably connected to the terminals 47a

and 47b. When a tester mode for checking electric systems is selected by operating the keyboard 32 of the diagnosis device 25, signals from the A/D converter 44 are selectively applied to the control unit 28 so as to make calculation dependent on the signals.

Before performing the diagnosis program, the control system 2 is temporarily connected to the diagnosis device 25 through the harness 27 and cartridge 34 is attached to the diagnosis device 25. The probes 46 are attached to the terminals 47a, 47b.

The operation of the system is described hereinafter with reference to the flowchart of Fig. 3. The engine is started, and the following diagnosis program is performed under the running of the engine.

The power switch 43 is turned on at a step S101. At a step S102, initialization of the control unit 28 is performed. A diagnostician operates the keyboard 32 to perform the diagnosis of the engine or of the electric system. For example, when the injection pulse width is confirmed, a mode code or mark for the pulse width (for example F → 1 → 2 → ENT) is input by operating the keyboard 32. On the other hand, when the electric system is checked, another mode code (for example, F → A → 2 → ENT) is input. At a step S103, the mode code is stored in the RAM 37 and stored mode is read by the CPU 36. At a step S104, it is determined whether the input

mode is a diagnosis mode or a tester mode. At the diagnosis mode the program goes to a step S105.

(Diagnosis Mode)

At the step S105, a corresponding data demand signal TX is applied to the system 2. At a step S106, a data signal RX representing a fuel injection pulse width is applied to the unit 28 from the control system 2. At a step S107, the received binary digit is converted into decimal digit representing the pulse width. At a step S108, a pulse width, for example, 1.3 msec is displayed on the display 31 as shown in Fig. 1a. Thus, the diagnostician can diagnose the item about the fuel injection pulse width.

(Tester Mode)

When the keyboard 32 is operated to input the tester mode code such as F → A → 2 → ENT at the step S103, the program proceeds to step S109 for checking the electric system at tester mode. The diagnostician manipulates the probes 46 so as to bring the probe tips 46a temporarily into contact with specific terminals in the electrical system. Accordingly, an analog signal representing data such as voltage between the terminals is applied to the A/D converter 44 where the analog signal is converted into a digital signal. The digital signal is applied to the control unit 28. The program proceeds to the steps S107 and S108, thereby converting a bianary digit to a decimal digit representing the voltage and displaying the voltage, for example 7v, on the display 31 as shown in Fig. 1b.

If the terminal voltage is not obtained, disconnection of harness or defective grounding is inferred. Accordingly, checks on the related parts are further carried out.

As shown by chain lines 44a in Fig. 2b, the A/D converter 44 may be provided in the control unit 28 so as to be connected with the CPU 36 through the bus line 35. In such a case, the terminals 48a and 48b are formed in the diagnosis device 25 as shown in Fig. 1a.

From the foregoing it will be understood that the present invention provides a dianosis system for a motor vehicle where both electronic control system and electric system can be checked with a single device so that operability and efficiency are improved.

While the presently preferred embodiment of the present invention has been shown and described, it is to be understood that this disclosure is for the purpose of illustration and that various changes and modifications may be made without departing from the scope of the invention as set forth in the appended claims.

CLAIMS

1. A diagnostic device for diagnosing an electronic control system of a motor vehicle, said device comprising a control unit including a computer having a central processing unit and a memory having a plurality of programmes for diagnosing the control system; an analogue to digital converter having input terminals arranged to receive analogue signals from electrical components of the vehicle and output terminals connected to the computer; and means for temporarily connecting the control unit to the electronic control system.

2. A diagnostic device as claimed in claim 1 in which the input terminals of the converter are temporarily connectable to electrical components of the vehicle by hand held probes.

3. A diagnostic device as claimed in claim 2 in which the diagnostic device has an outer casing with external terminals to which the probes are connectable and said terminals being connected to the input terminals of the converter.

4. A diagnostic device as claimed in claim 3 in which the terminals are on the casing of a cartridge detachably secured to the casing of the device.

5. A diagnostic device for diagnosing an electronic circuit system of a motor vehicle substantially as hereinbefore described with reference to the accompanying drawings.

Published 1989 at The Patent Office, State House, 66 71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office. Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Multiplex techniques ltd. St Mary Cray, Kent, Con. 1/87